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ABSTRACT

This paper explores the issue of the social relevance of instructional technology research, and examines the state of research in the field today. A modification of Dick and Dick's (1989) research article classification scheme is used to categorize the field's research literature. This new classification scheme represents an effort to distinguish between the goals of research and the methods of research. It is proposed that most research studies in instructional technology can be classified according to the six research goals defined in the paper: theoretical; empirical; interpretivist; postmodern; developmental; and evaluation. The proposed methodology classification includes: quantitative; qualitative; critical theory; literature review; and mixed-methods. Matrices of research goals by research methods are provided for 104 articles published in "Educational Technology Research and Development" from 1989-1994, and 129 articles published in "Journal of Computer-Based Instruction" from 1988-1994. The most common type of article in either publication is empirical in intent and quantitative in method. The next largest subset can be classified as theoretical in intent and employing literature review as the primary method. There is a paucity of interpretivist articles, developmental research studies, and a complete absence of any articles that are postmodern in intent or that employ critical theory as a methodology. The quality of contemporary research in the field is criticized, with many articles being characterized as pseudoscience, having the following characteristics: specification error; lack of linkage to robust theory; inadequate literature review; inadequate treatment implementation; measurement flaws; inconsequential outcome measures; inadequate sample sizes; inappropriate statistical analysis; and meaningless discussion of results. It is proposed that meaningful research can be conducted provided the sterility of existing research is acknowledged, and the profession builds anew from a foundation of sound learning theory and rededicated concern for the social impact of research. Data is illustrated in four figures. (Contains 54 references.) (MAS)

Title:

Questioning the Questions of Instructional Technology Research

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My First Flame

In April 1994, I was "flamed" on the Internet, a '90s phenomenon that has been portrayed in publications as diverse as *The New Yorker* (Seabrook, 1994) and *The Chronicle of Higher Education* (Lemisch, 1995). Although what exactly constitutes a "flame" in the rapidly evolving "metaverse" (Stephenson, 1993) is a matter of much debate, I can vividly recall the feelings of shock and anger that swept through me when I read the note calling me a "jerk" on a "listserv" shared by hundreds of members around the world.

It all began last spring when I read two queries from doctoral students on the Qualitative Research for the Human Sciences listserv <QUALRS-L@uga.cc.uga.edu>. Both students came from large public institutions of higher education, one in the USA and the other in Canada. The first student wrote that she intended to focus her dissertation research on the quality of "discourse" that takes place in cafes and coffee shops located inside bookstores. She complained that she had found no "literature" on this topic and asked the listserv participants for some guidance. The second student announced that he was preparing a dissertation prospectus centered on the question of how people learned about opportunities to take SCUBA diving lessons and what motivated them to register for such courses. He also sought directions to relevant literature and advice from the listserv membership.

After pondering these queries, I posted a message asking whether faculty members at taxpayer-supported universities have a moral responsibility to guide their students toward "socially responsible" research questions. In my posting, I suggested that in the face of problems such as adult illiteracy, attacks on public education, "at-risk" students, homelessness, AIDS, and the like, faculty members should attempt to inspire in students a dedication to research that would "make a difference."

Soon after posting my note, the graduate student who had sought help with his SCUBA query "flamed" me with his "jerk" note in which he went on to criticize my "attack" on his freedom to address whatever research questions interested him, especially given he was a taxpayer as well. A small grass fire of flames then erupted as several listserv members castigated the student for calling me a jerk, some agreed with my critique, and others defended the perspective that the social relevance of doctoral dissertation research (or any educational research) was irrelevant. No resolution of this issue was reached on the listserv, but I was especially impressed by the response of an education professor from a large land grant university in the USA who agreed with my criticism, but went on to suggest that much of the research he has read in the field of instructional technology could be subjected to a similar critique. This prompted me to ponder the social relevancy of research in our field.

Is Instructional Technology Research Socially Relevant?

Social relevance is an issue that is obviously subject to much debate. One's age, race, gender, socioeconomic status, education, religion, political allegiance, and many other factors are likely to influence one's interpretation of the social relevance of any given research study. Nevertheless, for the sake of this analysis, I will attempt to define social relevance with respect to scientific inquiry. My definition is based upon the following principles that guide scientific research (derived from Casti, 1989):

- Science is an ideology that consists of a cognitive structure concerning the nature of reality together with processes of inquiry, verification, and peer review.
- Views of reality differ according to one's philosophy of science, e.g., realism maintains that an objective reality exists, instrumentalism asserts that reality is the readings noted on measuring instruments, and relativism claims that reality is what the community says it is.
- Scientific research is a social activity that has certain standards and norms, e.g., it should not intentionally harm humans and it must be able to be replicated by other researchers.
- Socially responsible research in education adheres to the basic principles listed above while at the same time it addresses problems that detract from the quality of life for individuals and groups in society, especially those problems related to learning and human development.

In the view of some, instructional technology research might lay claim to a blanket *imprimatur* with respect to being "socially responsible." After all, at some level, all instructional technology research can be said to focus on questions of how people learn and perform, especially with respect to how learning and performance are influenced, supported, or perhaps even caused by technology. As long as research is focused on learning and performance problems, and adheres to the principles listed above, it would seem to be socially responsible.

Others in the research community argue that concern for the social responsibility of research in instructional technology or any other field is ludicrous. They maintain that the goal of research is knowledge in and of itself, and that whether research is socially responsible is a question that lies outside the bounds of science (cf., Carroll, 1973). In my experience, researchers in the natural sciences such as biology and chemistry do not often concern themselves with the relevance question, but this is a debate that has raged for decades among educational researchers (see Note 1). For example, as reported by Farley (1982), Nate Gage, a past president of the American Educational Research Association (AERA), has been a staunch defender of the notion that the goal of basic research in education is simply "more valid and more positive conclusions" (p. 12) whereas another past president of AERA, Robert Ebel, proclaimed:

....the value of basic research in education is severely limited, and here is the reason. The process of education is not a natural phenomenon of the kind that has sometimes rewarded scientific investigation. It is not one of the givens in our universe. It is man-made, designed to serve our needs. It is not governed by any natural laws. It is not in need of research to find out *how* it works. It is in need of creative invention to *make* it work better. (p. 18, Ebel's italics).

In my opinion, Ebel's stance (with which I agree) is directly relevant to the issue of socially responsible research in instructional technology. There is little social relevance in research studies that are largely focused on understanding "how" instructional technology works, without substantial concern for how this understanding makes education better. On the other hand, there is considerable social relevance in I.T. research studies that are largely focused on making education better (and which in the process may also help us understand more about how instructional technology works).

Most of the research in instructional technology is grounded in a "realist" philosophy of science, i.e., conducted under the assumption that education is part of an objective reality governed by natural laws and therefore can be studied in a manner similar to other natural sciences such as chemistry and biology. If this assumption about the nature of the phenomena we study is erroneous (and I believe it is), then we inevitably ask the wrong questions in our research. Further, even if there are underlying laws that influence learning, the complexity inherent in these laws may defy our ability to perceive, much less control, them (Casti, 1994). As Cronbach (1975) pointed out two decades ago, our empirical research may be doomed to failure because we simply cannot pile up generalizations fast enough to adapt our instructional treatments to the myriad of variables inherent in any given instance of instruction.

Of course, I am not the first person to express concerns about the nature of research in instructional technology. I adopted the title of this paper from one published twenty-seven years ago by Keith Mielke (1968) titled "Questioning the Questions of ETV Research." Other critics of the questions and methods of research in instructional technology include Lumsdaine (1963), Schramm (1977), Clark (1983), and Salomon (1991). The debate about the nature of reality and the conduct of research in our field continues as evidenced by the recent spate of articles focused on the question of "Does media influence learning?" (Clark, 1994a, b; Jonassen, Campbell, & Davidson, 1994; Kozma, 1994a, b; Morrison, 1994; Reiser, 1994; Ross, 1994a, b; Shrock, 1994; Tennyson, 1994; Ullmer, 1994). However, few critics have dealt directly with questions of whether instructional technology research is, can be, or should be socially responsible. That is the purpose of this paper.

The State of Instructional Technology Research

Before returning to the issue of the social relevance of instructional technology research, it is necessary to examine the state of research in the field today. To accomplish this, I reviewed the contents of two of the primary research journals in the field, the *Educational Technology Research and Development* (ETR&D) journal and the *Journal of Computer-based Instruction* (JCBI) over the periods 1989-94 for ETR&D and 1988-93 for JCBI (see Note 2).

For this review, I originally intended to use a research article classification scheme developed by Dick and Dick (1989) (see Figure 1), but my initial attempts to categorize articles using that scheme led to several difficulties, especially in terms of classifying studies that were primarily interpretivist in intent and naturalistic in method, e.g., Neuman (1991).

Literature review	a summary of a body of literature, sometimes as a critique and sometimes as a statement of the state of the art.
Methodological article	a new model or procedure for carrying out a technical activity.
Theoretical article	one which primarily draws upon and contributes to the theoretical literature of the field.
Empirical and experimental studies	all studies, other than evaluations, which use data in order to draw conclusions.
Descriptive study	a presentation of information about a particular program or event, with little or no use of data.
Evaluation study	a presentation of data and information to describe the effectiveness of a particular program or method, usually in an applied setting.
Professional article	a description of topics dealing with the profession of instructional technology, such as determination of competencies or descriptions of internship programs.

Figure 1. Research article classification scheme from Dick and Dick (1989).

After reflection and consultations with several research experts, I modified the classification scheme (see Note 3) This new classification scheme represents an effort to distinguish between the goals of research and the methods of research. First, I propose that most research studies in instructional technology can be classified according to the six research goals represented in Figure 2. This scheme is partially based upon discussions of research "paradigms" that have dominated educational research literature in recent years. For example, according to Soltis (1992), there are currently "three major paradigms, or three different ways of investigating important aspects of education" (p. 620) used in educational research: 1) the positivist or quantitative paradigm, 2) the interpretivist or qualitative paradigm, and 3) the critical theory or neomarxist paradigm. Although the "paradigm debate" literature is fascinating, I do not feel that the three categories presented by Soltis (1992) and others (e.g., Schubert & Schubert, 1990) capture the full breadth of research goals in the field of instructional technology. At the same time, there may be other goals of inquiry that are not be included in this scheme.

Theoretical	research focused on explaining phenomena through the logical analysis and synthesis of theories, principles, and the results of other forms of research such as empirical studies.
Empirical	research focused on determining how education works by testing conclusions related to theories of communication, learning, performance, and technology.
Interpretivist	research focused on portraying how education works by describing and interpreting phenomena related to human communication, learning, performance, and the use of technology.
Postmodern	research focused on examining the assumptions underlying applications of technology in human communication, learning, and performance with the ultimate goal of revealing hidden agendas and empowering disenfranchised minorities.
Developmental	research focused on the invention and improvement of creative approaches to enhancing human communication, learning, and performance through the use of technology and theory.
Evaluation	research focused on a particular program, product, or method, usually in an applied setting, for the purpose of describing it, improving it, or estimating its effectiveness and worth.

Figure 2. Research goal classification scheme.

Second, given the aforementioned desire to separate the goals of research studies from the methodologies employed in them, I propose the methodology classification scheme represented in Figure 3. Of course, there are numerous methods available to researchers in instructional technology (cf., Driscoll, 1995), but for the sake of simplicity, these five methodological groupings provide sufficient discrimination to allow the analysis represented below.

Quantitative	experimental, quasi-experimental, correlational, and other methods that primarily involve the collection of quantitative data and its analysis using inferential statistics.
Qualitative	observation, case-studies, diaries, interviews, and other methods that primarily involve the collection of qualitative data and its analysis using grounded theory and ethnographic approaches.
Critical Theory	deconstruction of "texts" and the technologies that deliver them through the search for binary oppositions, hidden agendas, and the disenfranchisement of minorities.
Literature Review	various forms of research synthesis that primarily involve the analysis and integration of other forms of research, e.g., frequency counts and meta-analyses.
Mixed-methods	research approaches that combine a mixture of methods, usually quantitative and qualitative, to triangulate findings.

Figure 3. Research methods classification scheme.

The combination of the goal classification and the methods classification schemes yields a matrix of research goals by research methods. Figure 4 presents my analysis of the research articles published in ETR&D (1989-1994). There were one hundred and four articles published in the research section of ETR&D in the six years from 1989 through 1994 (see Note 4). Not every article could be classified according to the classification matrix illustrated in Figure 4. Six "methodological articles" (presenting a new method or procedure for carrying out research) and three "professional articles" (analyzing the state of the profession of instructional technology) are not included in Figure 4.

	Quantitative	Qualitative	Critical Theory	Literature Review	Mixed-methods
Theoretical				31	
Empirical	39	3		1	5
Interpretivist		1			
Postmodern					
Developmental		1		4	1
Evaluation		2		2	5

Figure 4. Classification of ETR&D articles (1989-94).

Figure 5 is an analysis of the research articles published in JCBI (1988-1993). There were one hundred and twenty-nine articles published in JCBI from 1988 through 1993. Five "methodological articles" and one "professional article" are not included in Figure 5.

	Quantitative	Qualitative	Critical Theory	Literature Review	Mixed-methods
Theoretical				17	
Empirical	56			1	4
Interpretivist		2			1
Postmodern					
Developmental				3	2
Evaluation	7	4		3	23

Figure 5. Classification of JCBI articles (1988-93).

There are some obvious trends in the articles that appeared in ETR&D and JCBI during the respective review periods. First, the most common type of article in either publication is empirical in intent and quantitative in method. Thirty-nine articles (38% of the total 104) in ETR&D and fifty-six articles (43% of the total 129) in JCBI fall into the "empirical-quantitative" cell of the matrix.

The next largest subset of articles in these publications can be classified as theoretical in intent and employing literature review as the primary method. I was liberal in my classification of articles into this category. For example, I assigned all of the aforementioned media debate articles into this classification (cf., Clark, 1994a, b; Kozma, 1994a,b). The extent to which literature review methods were actually used in these articles varies greatly.
Another trend that stands out is the paucity of interpretivist articles (one in ETR&D and three in JCBI) during this time. This seems surprising given the numerous applications of the "Constructivist-Hermeneutic-Interpretivist-Qualitative Paradigm" in other fields of education (cf., Eisner, 1991). Although Neuman (1989), Driscoll (1995), Robinson (1995) and others promote interpretivist approaches to research in instructional technology, interpretivist research reports rarely find their way into our publications.

Develo, ..ntal research studies are also scarce in each of these publications. With respect to ETR&D, it may be that most developmental research studies appear in the development section of the journal, but this is a hypothesis that has not been investigated. Other possible explanations are that instructional technologists rarely conduct developmental research, those that do have too little time to report it, or the review panels for the journals do not recognize this approach as legitimate research.

The complete absence of any articles in these journals that are postmodern in intent or that employ critical theory as a methodology is disappointing, but not too surprising. First, Hlynka and Belland's (1991) volume on the application of postmodern criticism to instructional technology may not be widely known. Second, the gatekeepers of ETR&D and JCBI appear to have strong preferences for empirical research employing quantitative methods. They may be unwilling or unable to entertain such radical departures from standard research methods as have been proposed by Yeaman (1994) and other critical theorists.

An interesting difference between the two journals is the percentage of articles that are evaluative in intent. Only nine (9%) of the articles in ETR&D were evaluation reports during this period whereas thirty-seven (29%) of the articles in JCBI were evaluations. This difference may be explained by evaluation articles in ETR&D being primarily relegated to the development section of the journal. As above, this hypothesis has not been investigated.

The Problem of Pseudoscience

A deeper analysis of those studies published in ETR&D and JCBI which are empirical in intent and quantitative in method yields a dismal picture of the quality of contemporary research in our field. In an earlier article published in the now defunct JCBI (Reeves, 1993), I presented an analysis of five studies published in refereed journals from the literature on learner control (Arnone & Grabowski, 1992; Kinzie & Sullivan, 1989; López & Harper-Meriniak, 1989; McGrath, 1992; Ross, Morrison, & O'Dell, 1989). I characterized the research reported in these articles as pseudoscience. Figure 6 summarizes the characteristics of pseudoscience in the field of instructional technology.

Ironically, the learner control articles analyzed in Reeves (1993) are hardly the worst examples of pseudoscience in our field. My analysis of recent volumes of ETR&D and JCBI indicates that pseudoscience continues to dominate research in the field of instructional technology. A conservative review of the thirty-nine "empirical-quantitative" studies reported in ETR&D indicates that twenty-eight of them (72%) can be identified as examples of pseudoscience in that they possess two or more of the characteristics in Figure 6. In JCBI, thirty-four (61%) of the fifty-six "empirical-quantitative" studies published during this period suffer two or more signs of pseudoscience. This analysis is evidence of a research malaise of epidemic proportions.

Specification error	Vague definitions of the primary independent variables (e.g., learner control versus program control).
Lack of linkage to robust theory	Little more than nominal attention to the underlying learning and instructional theories that are relevant to the investigation.
Inadequate literature review	Cursory literature review focused on the results of closely related studies with little or no consideration of alternative findings.
Inadequate treatment implementation	Infrequent (usually single) treatment implementation often averaging less than 30 minutes.
Measurement flaws	Precise measurement of easy-to-measure variables (e.g., time); insufficient effort to establish the reliability and validity of measures of other variables.
Inconsequential outcome measures	A lack of intentionality in the learning context, usually represented by outcome measures that have little or no relevance for the subjects in the study.
Inadequate sample sizes	Small samples of convenience, e.g , the ubiquitous undergraduate teacher education or psychology majors.
Inappropriate statistical analysis	Use of obscure statistical procedures in an effort to tease statistically significant findings out of the data.
Meaningless discussion of results	Rambling, often incoherent, rationales for failing to find statistically significant findings.

Figure 6. Characteristics of pseudoscience (Reeves, 1993).

The question inevitably arises with respect to how so many pseudoscience studies get published. At least part of the answer rests in the incestuous nature of the relationships among the people conducting these studies and the people charged with peer review of these submissions. The review boards of these journals include many of the same people whose research studies exemplify pseudoscience. Not only does the insular nature of the review process assure these researchers of a venue for their pseudoscience reports, but it also at least partially explains the under representation of alternative approaches of inquiry.

To understand the steady flow of pseudoscience in instructional technology, it is necessary to look at its source. Most of it emanates from colleges and schools of education that have graduate programs in instructional technology. As Kramer (1991) points out in *Ed School Follies*, these institutions are "intent on proving that education is an academic discipline with its own subject matter worthy of a place alongside other university schools and departments (p. 8). The faculty in these programs are subject to the same "publish or perish" pressure as their colleagues in arts and sciences. They quickly learn that it is the number of refereed publications they can amass, not the relevance or value of their research, that really matters when they come up for tenure and promotion.

Needless to say, this problem is hardly limited to instructional technology programs. Colleges and schools of education reward pseudoscience in every discipline from early childhood education though vocational education. A new report issued by the Holmes Group called "Tomorrow's Schools of Education," calls for tenure and promotion guidelines to be revamped so that professors are rewarded less for research and publication and more for work in the public schools (Nicklin, 1995). If such a radical shift in the reward structure could be accomplished, I cannot believe that we would continue to conduct pseudoscience when we could be rewarded for making a difference in the schools where the needs are so great.

Frankly, the likelihood of changing the reward structure within universities seems at best remote. However, as instructional technologists, we do not have to wait for such a change to occur. Another way of increasing the relevance of instructional technology would be to call a moratorium on our efforts to find out how instructional technology can effect learning through empirical research. Instead, we should turn our attention to making education work better. It seems obvious to me that we stand a better chance of having a positive influence on educational practice if we engage in developmental research situated in schools with real problems.

Can reports of developmental research be published? Of course! After all, as noted above, the same people who conduct the research are the gatekeepers who determine what is accepted for publication in our most important journals. As academics, we are all in this together, and if we want to fundamentally change the nature of our "game," we can. In this manner, we can still meet the frustrating, but practical, requirements of the larger academic game by providing our instructional technology scholars with an outlet in refereed publications, albeit ones that have been radically improved in terms of goals, methods, and relevancy.

Steps Toward Socially Responsible Research

The relevance of pseudoscience research studies is a moot point. Even if the researchers themselves ascribe to the highest ideals of scientific inquiry, research so flawed has little relevance for anyone other than the people who conduct and publish it. But it is not enough to criticize research in instructional technology as characterized by pseudoscience and social irrelevance. Alternatives to the old ways must be found. Some may demur, believing that instructional technologists are incapable of conducting valid, socially relevant research, and that they should stick to instructional design and evaluation, leaving educational research to cognitive psychologists or practitioners better equipped to conduct it. I disagree. I think we can and will conduct meaningful research provided we acknowledge the sterility of our existing research base and build anew from a foundation of sound learning theory and rededicated concern for the social impact of our research.

What would be the nature of a new socially relevant research agenda? Two recent studies that represent a change in direction toward developmental research are the dissertation study conducted by Idit Harel at M.I.T. (1991) and the on-going research of Richard Lehrer (1993) and his associates at the University of Wisconsin.

Harel's (1991) Instructional Software Design Project (ISDP) represents a unique effort to use programming as a cognitive tool within a software design context. Harel's ISDP combines Papert's "constructionist" theory (1993) with Perkins "knowledge as design" pedagogy (1986). In her dissertation research, seventeen fourth grade students used Logo for a semester to create software products that were intended to teach fractions to third grade students. Her study combined quantitative, qualitative, and comparative research methods to investigate the effects of this "learners as designers" approach.

Harel reports that the fourth grade students spent an average of seventy hours working on their software design projects. The actual nature of the software the students designed was open, but they were two requirements for students in the program: 1) writing in a "Designer's Notebook" every day, and 2) attending periodic "Focus Sessions" about software design, Logo programming, and fractions. A teacher and the researcher were available at all times to help the students with their design efforts. Although each of the students produced a separate software product, collaboration among the students was encouraged.

Harel compared the differences in Logo skills and fractions knowledge between the seventeen students in the ISDP and thirty-four other students in two classes who were studying Logo and fractions via "a traditional teaching method" (p. 263). No significant differences were found in pretests among the three classes. Harel reports that "In general, the 17 children of the experimental class did better than the other 34 children on all posttests (Fractions and Logo)" (p. 272). Although not all differences were statistically significant, the general trend was quite positive in terms of specific learning outcomes as measured by multiple measures including paper-and-pencil tests, computer exercises, video-taped observations, and interviews.

The major part of Harel's (1991) study is a detailed description of the activities and metacognition of one student, "Debbie," over the four month period of the project. Harel wrote that her detailed analysis of Debbie's work as well as her observations of other students indicated that "Throughout ISDP, the students were constantly involved in metacognitive acts: learning by explaining, creating, and discussing knowledge representations, finding design strategies, and reflecting on all of the above" (p. 359). In addition to positive cognitive effects in terms of metacognition, Harel concluded that the ISDP students acquired enhanced cognitive flexibility, better control over their problem-solving, and greater confidence in their thinking abilities. She notes however that the study did not include any direct measures of thinking skills, but is grounded in her own interpretations of the students' metacognition and problem-solving processes based upon observations and analysis of documentation such as their Designer's Notebooks.

Lehrer (1993) describes the development, use, and results of a hypermedia construction tool called *HyperAuthor* that eighth graders used to design their own lessons about the American Civil War. This approach is based upon the cognitive learning theory that knowledge is a process of design and not something to be transmitted from teacher to student (Perkins, 1986). Lehrer's students were engaged in "hyper-composition" by designing their own hypermedia. In this mode, learners transform information into dimensional representations, determine what is important and what is not, segment information into nodes, link the information segments by semantic relationships, and decide how to represent ideas. This is a highly motivating process because authorship results in ownership of the ideas in the hypermedia (Jonassen, in press).

Lehrer's subjects were high and low ability eighth graders who worked at the hypermedia construction tasks for one class period of 45 minutes each day over a period of several months. The students worked in the school's media center where they had access to a color Macintosh computer, scanner, sound digitizer, *HyperAuthor* software, and print and non-print resources about the Civil War. An instructor was available to coach students in the conceptualization, design, and production of hypermedia. Students created programs reflecting their unique interests and individual differences. For example, they created hypermedia about the role of women in the Civil War, the perspectives of slaves toward the war, and "not-so-famous people" from that period.

According to Lehrer, "The most striking finding was the degree of student involvement and engagement" (p. 209). Both high and low ability students became very task-oriented, increasingly so as they gained more autonomy and confidence with the cognitive tools. At the end of the study, students in the hypermedia group and a control group of students who had studied the Civil War via traditional classroom methods during the same period of time were given an identical teacher-constructed test of knowledge. No significant test differences were found. Lehrer conjectured that "these measures were not valid indicators of the extent of learning in the hypermedia design groups, perhaps because much of what students developed in the design context was not anticipated by the classroom teacher" (p. 218).

However, a year later, when students in the design and control groups were interviewed by an independent interviewer unconnected with the previous year's work, important differences were found. Students in the control group could recall almost nothing about the historical content, whereas students in the design group displayed elaborate concepts and ideas that they had extended to other areas of history. Most importantly, although students in the control group defined history as the record of the facts of the past, students in the design class defined history as a process of interpreting the past from different perspectives. In short, the hypermedia "design approach lead to knowledge that was richer, better connected, and more applicable to subsequent learning and events" (p. 221).

A New Beginning

What a contrast exists between the Harel (1991) and Lehrer (1993) studies and the morass of pseudoscience endemic in our field! In the first instances, pedagogical models grounded in robust learning theories have been identified, and subsequently, powerful technologies have been used to implement these models. In the latter, the power of various forms of technology to instruct is assumed, and reductionist experiments are conducted to detect its effects. In Harel's study, children with authentic needs experienced a powerful learning opportunity over a period of months. In most pseudoscience studies, undergraduates earn "extra credit" for less than an hour of their time spent using some form of mediated "treatment" that has little or no relevance for them.

In a landmark paper about educational research, Salomon (1991) describes the contrast between analytic and systemic approaches to research. Salomon claims that this contrast transcends the "basic versus applied" or "quantitative versus qualitative" arguments that so often dominate debates about the relevancy of educational research. Salomon concludes that the analytic and systemic approaches are complementary, arguing that "the analytic approach capitalizes on precision while the systemic approach capitalizes on authenticity" (p. 16).

While I agree with Salomon in theory, the dominance of pseudoscience in I.T. invalidates this complementarity in practice. The ugly truth is that many of us who engage in analytic research approaches consistently violate many of the basic premises of this paradigm, especially with respect to the testing of meaningful hypotheses derived from strong theory (Reeves, 1993). Although we may eventually be able to conduct valid, socially responsible analytic studies in this field, that time has not yet arrived. We need a valid body of systemic (interpretivist, postmodern, and developmental) research before we begin to have theoretical foundations strong enough to pursue an analytical agenda.

Is instructional technology research socially responsible? At the present time, it is not. Are we asking the wrong questions? For the most part, yes. Can we change this sad state of affairs? Of course, if we have the will! Salomon (1991) points the way. A major benefit of systemic research in education is that it yields new questions and nurtures the development of new theory. The aforementioned moratorium on analytic studies in our field could give us the theoretical foundations for a socially relevant analytic research agenda early in the 21st Century. There are hopeful signs as indicated by the studies of Harel (1991) and Lehrer (1993) and the methodological prescriptions of Neuman (1989), Newman (1990), and Salomon (1991).

I believe that the research malaise in I.T. stems in part from the "mindlessness" that is endemic in so much of our professional and personal lives as we near the 21st Century. Although some would attempt to redirect or revive the pseudoscience approach to I.T. research (cf., Ross & Morrison, 1989), it is clear that much of our research continues to suffer from the same mindless misconceptions and irrelevance identified by previous critics (Lumsdaine, 1963; Mielke, 1968; Schramm, 1977; Clark, 1983; Salomon, 1991). The social psychologist, Ellen Langer, documents the terrible costs of mindless behavior in education, health care, and business in her book 1989 book, *Mindfulness*. She writes:

When we are behaving mindlessly, that is to say, relying on categories drawn in the past, endpoints to development seem fixed. We are then like projectiles moving along a predetermined course. When we are mindful, we see all sorts of choices and generate new endpoints. Mindful involvement in each episode of development makes us freer to map our own course. (pp. 96-97)

The demise of JCBI, the recurring "influence of media" debate, and the prevalence of pseudoscience in our field are all signals that we need to become more mindful about our research. If we continue as before, mindlessly conducting pseudoscience, the obsolescence of our field per se is a likely outcome. Already, the most exciting learning and performance environments are not coming out of Departments of Instructional Technology (cf., Cognition and Technology Group at Vanderbilt, 1992; Gery, 1995). On the other hand, as Langer emphasizes, mindfulness opens up all kinds of possibilities. Let us seize this opportunity to stop being pawns in "someone else's costly construction of reality" (p. 28) and realize that we, and we alone, can assure the validity and social relevance of research in instructional technology.

Background of Author

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Notes

1. The belief that biologists and other natural scientists don't have to be as concerned about the social relevance of their research as social scientists is being tested in the courts (Leatherman, 1995). A female biology professor denied tenure at Vassar College sued on the grounds that the research of the male professors who voted on her tenure decision was less important than hers. The judge agreed finding that her research on skin differentiation might have "important implications" for cancer research whereas the research of the one of her male colleagues on spider behavior was "narrow" and subject to ridicule (p. A14).

2. Although I would have preferred to examine research publications in both journals during an identical six year period, this was not possible. ETR&D began its new format in 1989, and JCBI ceased publication at the end of 1993.

3. I am grateful to Marcy Driscoll, Don Ely, Kent Gustafson, Mike Hannafin, John Hedberg, and Walter Dick for their generous guidance in the development of this revised classification scheme. Of course, I take full responsibility for the flaws that will no doubt be revealed in its organization.

4. ETR&D is a product of the integration of two journals previously published by the Association for Educational Communications and Technology (*Educational Communications and Technology Journal* and

Journal of Instructional Development). ETR&D is divided into two sections, a research section and a development section. This analysis only considered the research section of ETR&D.

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